

Quarterly Report – Public Page

Date of Report: November 26, 2008

Contract Number: DTPH56-08-T-000009

Prepared for: DOT

Project Title: “Adaptation of MWM-Array and MFL Technology for Enhanced Detection/Characterization of Damage from Inside Pipelines”

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Public Page Section-

This project is aimed at developing improved nondestructive evaluation (NDE) methods for detection and characterization of damage in pipelines from inside the pipeline. The damage conditions of interest include internal and external corrosion, mechanical damage, and stress corrosion cracking (SCC). This will be accomplished by adapting JENTEK Sensors, Inc.'s MWM-Array technology and developing a field deployable MWM-Array tool for inspection from inside pipelines, as well as by applying JENTEK's model-based inverse methods to develop enhanced MFL methodologies. The magnetic field-based MWM-Arrays and model-based inverse methods are used to determine electromagnetic and geometric properties of the pipeline material, which are then related to specific damage conditions of interest. This technology has been successfully applied in the aerospace and manufacturing industries and provides substantially improved performance for imaging surface and buried damage compared to conventional NDE methods.

During the second period of this program, we have fabricated and acquired additional samples for testing purposes, continued to review development issues and requirements for integrating the sensing instrumentation with an ILI platform, and reviewed alternative sense element candidates for low frequency inspections. We have also continued to develop procedures, through both simulations and measurements, for damage inspections through coatings. The point of contact for this program is Andrew Washabaugh (jentek@shore.net, 781-642-9666).

General Information required on all Public Quarterly Reports

Results and Conclusions:

This section summarizes progress made in the combined program. This contract is aimed at developing instrumentation for characterizing damage in pipelines, including external corrosion, internal corrosion, stress corrosion cracking (SCC), and mechanical damage, with one set of tasks (No. 304) for inspection from outside the pipeline and another (No.

306) for inspection from inside the pipeline. This contract is complemented by funding from Chevron.

Progress has been made in a number of areas:

- **Samples with Representative Damage Conditions:** One aspect of this program has been on the identification of available samples or fabrication of samples having representative damage conditions for use in development of the measurement techniques. Pipeline samples for both usage-related damage and simulated damage conditions are being made available. Flat plate samples were fabricated and cylindrical pipe sections have been acquired for demonstration purposes and procedure development.
- **Sensor Response Simulations:** Numerous simulations were performed in order to understand the sensor responses to pipeline material condition over ranges of excitation frequencies. These simulations are guiding sensor modifications and the selection of sense elements for the inspection.
- **Alternative sense elements:** Several different devices were reviewed to determine benefits and disadvantages in use as low frequency elements in imaging sensor arrays. Low frequency measurements are required for the inspecting magnetic field to be able to penetrate through the pipeline thickness.
- **Demonstration Measurements:** Additional demonstration measurements for simulated near-surface material loss were performed using several JENTEK sensor arrays and a flat steel plate. These relatively high frequency measurements demonstrated how JENTEK's measurement grids and multivariate inverse methods can be used to rapidly provide images of areas with material loss.
- **ILI specifications:** A list of items that need to be considered in the adaptation of the MWM-Array sensing technology into an ILI tool was developed.

Plans for Future Activity:

1. Continue to acquire or fabricate specimens having representative damage conditions.
2. Simulate high frequency sensor operation to improve performance.
3. Adapt procedures and perform demonstrations for high-frequency measurements.
4. Simulate low frequency sensor operation to improve performance.
5. Adapt instrumentation to support low frequency measurements.
6. Adapt procedures and perform demonstrations for high-frequency measurements.